Science Toolkit: Grade 8 Objective 1.A.1.e

Student Handout: Science: Grade 8 Objective 1.A.1.e

Standard 1.0 Skills and Processes

Topic A. Constructing Knowledge

Indicator 1. Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided.

Objective e. Explain that if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one of the variables.

Selected Response (SR) Item

Question

Use the technical passage "A Sea Wall Just One Molecule High" to answer the following.

Students investigated producing waves on the surface of the water in a container. The students filled four identical containers with the same amount of water. Five milliliters of oil was then added to three of the four containers. An electric fan was used to produce wind across the surface of the water in each container. The fan had four speeds; 1 was the slowest speed and 4 was the fastest.

Container	Type of Oil	Fan Speed
L	None	1
M	Canola	2
N	Corn	3
O	Olive	4

Which statement best describes an error the students made in this investigation?

A. The students did not use a control.
B. The students changed more than one variable.
C. The students used the same amount of water.
D. The students used an electric fan instead of natural wind.

Correct Answer

B. The students changed more than one variable.

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Handouts

A Sea Wall Just One Molecule High

"There was a large pond, very rough with wind. I dropped a little oil on the water. Though not more than a teaspoonful, it produced an instant calm, [making the water] as smooth as a looking glass."

An incredible experiment, but even more so because of who performed it—Benjamin Franklin, in 1762! Aside from his political influence, Franklin was one of his day's greatest scientists. Did the inventor of the lightning rod also discover a way to calm waves?

In a way, yes. Oil films can be extremely thin—in places, just one molecule high. So how can a barrier that shallow stop waves? One secret is in the molecules. Molecules of oil lack the bond strength found in water. Because of oil's weaker bonds, wind can't push it nearly as well. So oily water produces smaller waves.

In fact, you can prove this idea yourself. Set some thread on a cup of water. Instead of sinking, it floats on the surface, because water's strong bonds form a kind of "sheet." Then set a similar thread on a cup of oil. It sinks. Oil's bonds are too weak.

In olden days, sailors used oil-soaked rags to calm the water around their ship. Sadly, today, the ocean is often calm where oil tankers have accidentally leaked their cargo into the sea.

Of course, making giant oil spills is not a responsible way to control ocean waves. However, researchers at the University of California at Berkeley may have discovered an amazing piece of Franklin's puzzle.We usually think of oil as slippery. However, the whirling mist of droplets that rises off ocean waves is even slicker.Wave spray is so slick that it lets wind blow over the water until it reaches hurricane speed. And that makes the waves even bigger.

In theory, a film of oil on the water might reduce this wave spray, slowing the wind and calming the waves. There are harmless oils available that would break down naturally. The approach might not work in an actual storm, with so much water to cover. Still, it reveals some intriguing new wave science—that's really centuries old!
